

REMARKS

By this Amendment, new Claims 45-47 have been added, leaving claims 11-14 and 29-47 pending in the application. No new matter has been added. Favorable consideration of this application is respectfully requested.

Personal Interview

Applicant thanks Examiner Deo for the courtesies extended to their undersigned representative during the personal interview conducted on February 22, 2007. During the personal interview, the claimed subject matter and U.S. Patent No. 6,464,843 to Wicker et al. ("Wicker") were discussed.

Rejection Under 35 U.S.C. § 103

Claims 11-14 and 29-44 were rejected under 35 U.S.C. § 103(a) over admitted prior art ("APA") and Wicker. The reasons for the rejection are set forth at page 2 of the Official Action. The rejection is respectfully traversed.

Claim 11 recites a silicon carbide component for a semiconductor substrate processing apparatus. The silicon carbide component is porous and comprises an interior and an exposed surface, the silicon carbide component having been (i) made by a graphite conversion process that results in the silicon carbide component including free-carbon in graphite form in the interior; (ii) treated to produce an exposed surface having the free-carbon in graphite form therein; and (iii) treated to remove the free-carbon such that at least the exposed surface is substantially free of the free-carbon. The silicon carbide component is selected from the group consisting of a baffle plate, a plasma confinement ring and an edge ring.

The silicon carbide component recited in Claim 11 has been made by a graphite conversion process that results in the silicon carbide component including free-carbon in graphite form in the interior. During the graphite conversion process, the graphite is not completely converted to SiC and, as a result, graphite is present in the interior of the silicon carbide component in the form of particles or clusters. As also recited in Claim 11, the silicon carbide component has been treated to produce an exposed surface having the free-carbon in graphite form therein. The graphite on the exposed surface of the component is an undesirable source of particles ("adders") when the component is installed in a plasma processing chamber and exposed to plasma during processing of production wafers. As recited in Claim 11, the silicon carbide component has been treated to remove the free-carbon such that at least the exposed surface is substantially free of the free-carbon.

The Office takes that the position that APA describes silicon carbide components, such as a baffle plate, confinement ring and edge ring, having free-carbon in graphite form in the interior and on the exposed surface due to incomplete conversion of the carbon to make silicon carbide during the manufacturing process, such as ones from Poco Graphite, Inc. The Office acknowledges that APA does not describe such silicon carbide components as being substantially free of free-carbon at least on the exposed surface (after being treated).

However, the Office further asserts that such components later go through different processes, such as oxygen cleaning steps taught by Wicker, referencing Wicker at column 7, lines 14-30. The Office contends that:

[T]his oxygen cleaning would provide these silicon carbide components that are substantially free of the free-carbon at least on the exposed surface. It is applicant's burden to show facts that applied prior art's product is not the same as that of the claimed product. (Emphasis added.)

Because Wicker does not provide an express disclosure of the oxygen cleaning producing silicon carbide components that are substantially free of the free-carbon at least on the exposed surface, it appears that the Office has taken an inherency position. However, "the mere fact that a certain thing *may* result from a given set of circumstances is not sufficient [to establish inherency]." *In re Rijckaert*, 28 U.S.P.Q.2d 1955, 1957 (Fed. Cir. 1993). Furthermore, "[t]hat which may be inherent is not necessarily known. Obviousness cannot be predicated on what is unknown" (citation omitted). *Id.*

A Declaration by Daxing Ren Under 37 C.F.R. 1.132 is submitted herewith as evidence to refute the Office's position. Mr. Ren is the inventor of the claimed subject matter. In the Declaration, Mr. Ren explains the meaning of chamber "conditioning" at paragraph (5). As explained, plasma etch chambers are conventionally "conditioned" prior to processing production wafers in the chambers. Chamber conditioning is a simulated production process that uses production process conditions, but instead of using production wafers, uses dummy wafers. Chamber conditioning is performed prior to processing production wafers in the plasma etch.

At paragraph (6), Mr. Ren explains that in the comparative testing described at paragraphs [0039] to [0041] of the present application, a plasma processing chamber was conditioned in two tests with a different converted SiC baffle plate being contained in the chamber during the respective conditioning processes. In test A, the chamber was conditioned with a silicon carbide baffle plate (baffle plate A) composed of converted SiC that was not previously treated to remove free-carbon (Curve A) installed in the chamber. In test B, the same conditioning process was run in the chamber, but with a silicon carbide baffle plate (baffle plate B) composed of converted SiC that was previously treated in an oven flowing O₂ at high temperature to remove free-carbon (Curve B) installed in the chamber. The baffle plates were both new parts, i.e., they had not previously been installed in a plasma processing chamber. The chamber hardware was the same for the tests except for the different silicon carbide baffle plates A and B.

As explained at paragraph (7) of the Declaration, the conditioning process used in tests A and B included a wafer-less autocleaning ("WAC") step, which was performed in the chamber after processing every 25 wafers and a resist ashing step, which was performed after processing every wafer. The total process time for each dummy wafer was about 4 minutes of RF time. In the WAC step, O₂ was used to generate an oxygen plasma to clean the chamber, and this step typically had a duration of about 60 seconds of RF time. In the resist ashing step, a resist layer was stripped from a dummy wafer using O₂ to generate an oxygen plasma in the dielectric etch chamber, and this step typically had a duration of about 45 seconds of RF time.

As explained at paragraph (8) of the Declaration, FIG. 1 of the present application shows the relationship between the number of particle adders deposited on 200 mm dummy wafers versus the duration (RF hours) of the chamber conditioning for tests A and B. The RF hours is the number of hours that a plasma was generated in the chamber during conditioning. Particle counts were obtained at specific intervals in each test (e.g., after a certain number of RF hours).

As explained at paragraph (9) of the Declaration, Curve B in FIG. 1 shows that the number of particle adders having a size of at least about 0.2 μm deposited on dummy wafers in the chamber containing treated baffle plate B was less than about 10 after only about 2 RF hours of chamber conditioning (which is equivalent to processing about 30 wafers), and the number of particle adders was further decreased to about 5 by extending the duration of the chamber conditioning. In contrast, Curve A shows that the number of particle adders deposited on dummy wafers in the chamber that contained un-treated baffle plate A was significantly higher than 20, even after more than 45 RF hours of testing (which is equivalent to processing about 675 wafers).

Mr. Ren states at paragraph (11) of the Declaration that the test results in FIG. 1 show that removing free-carbon from the silicon carbide baffle plate by treating in an oxygen-containing atmosphere outside a plasma processing chamber significantly reduces the generation of adder particles in the chamber during wafer processing operations compared to a baffle plate that was not subjected to such pre-treatment. As stated at paragraph (12) of the Declaration, as the test results shown by curves A and B differed only in that baffle plate B was a part treated to remove free-graphite in the interior of the baffle plate, because baffle plate A continued to

generate a large number of particles even after over 45 RF hours of chamber conditioning, it appears that a significant amount of free-graphite remained in baffle plate A and caused the higher particle generation shown in curve A. It is Mr. Ren's opinion that Wicker's conventional conditioning process would not be effective to remove free-graphite from the interior of a converted SiC component.

The comparative test results weigh against the assertion by the Office that Wicker's oxygen cleaning would (inherently) provide silicon carbide components made by the graphite conversion process that are substantially free of the free-carbon at least on the exposed surface. As set forth at M.P.E.P. § 716.02(b)(III), evidence of unexpected results can be in the form of direct or indirect comparison of the claimed subject matter to the closest prior art which is commensurate in scope with the claims. Applicant submits that unexpected results described in the present specification provide a comparison of the claimed subject matter to the "closest prior art," and are sufficient to rebut the alleged inherency and *prima facie* case of obviousness. Thus, Claim 11 is patentable over the applied art.

Claims 12-14, 32 and 33, which depend from Claim 11, are also patentable for at least the same reasons as those stated with respect to Claim 11.

Independent Claim 35 recites a silicon carbide component for a semiconductor substrate processing apparatus. The silicon carbide component comprises an interior and an exposed surface, the interior containing free-carbon in graphite form and the exposed surface being substantially free of the free-carbon. For reasons discussed above, the silicon carbide component recited in Claim 35 is also patentable. Claims 36, 40 and 41, which depend from Claim 35, are also patentable for at least the same reasons as those stated with respect to Claim 35.

Independent Claim 43 recites a silicon carbide baffle plate of a semiconductor substrate processing apparatus. The baffle plate comprises an interior and a machined exposed surface, the interior containing free-carbon particles or clusters in graphite form and the exposed surface being substantially free of the free-carbon.

The silicon carbide component recited in Claim 43 is also patentable.

Therefore, withdrawal of the rejection is respectfully requested.

New Claims

New Claims 45-47 depend from Claim 11, 35 and 43, respectively. Support for Claims 45-47 is provided at paragraph [0032] of the specification. Claims 45-47 are also patentable.

Conclusion

Should any questions arise in connection with this application or should the Examiner believe that a telephone conference with the undersigned would be helpful in resolving any remaining issues pertaining to this application, the undersigned respectfully requests that he be contacted at the number given below.

Respectfully submitted,

BUCHANAN INGERSOLL & ROONEY PC

Date: March 23, 2007

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